

**SECTION 16850**  
**ELECTRIC HEATING EQUIPMENT**

**PART 1 - GENERAL**

**0.1 DESCRIPTION OF WORK**

- A.** Work Included: This Section specifies furnishing, installing, connecting, testing, and placing in operation electrical heating devices and equipment for melting snow and ice at escalator entrances, platforms of surface of aerial passenger stations, and at track switches and third rail heaters.

**0.2 SUBMITTALS**

- A.** Submit the following to the Engineer for approval:
1. Catalog cuts of all standard cataloged equipment.
  2. Shop drawings of non-standard and non-cataloged items;
  3. Heater layout drawings;
  4. Schematic wiring diagrams for control systems;
  5. Wiring diagrams for heating systems;
  6. Heater and control equipment installation details; and
  7. Electric heating equipment schedule similar to the conventional lighting fixture schedules.
  8. Factory test reports.

**0.3 QUALITY ASSURANCE**

- A.** Perform the following factory testing of third rail heater cable assemblies:
1. Preparation. Immerse completed cable assemblies under water at minimum 50 pounds per square inch pressure for minimum one hour prior to testing.
  2. Tests.
    - a. Test A. Test resistance of mineral insulated cable with bridge type measuring device.
    - b. Test B. Test insulation resistance with 1000-volt direct current megger.
    - c. Test C. Perform hi pot test on mineral insulated cable with direct current hi pot machine designed for cable testing.
  3. Test Limits or Results
    - a. Test A. Results of testing shall be within 10 percent of design value.
    - b. Test B. Results of testing shall be 50 megohms minimum.

- c. Test C. Results of testing shall be that cable can withstand minimum 3,500 volts direct current for minimum of one minute with leakage of less than 3.5 microamperes.

## **PART 2 - PRODUCTS**

### **0.1 EMBEDDED RADIANT FLOOR HEATERS**

- A. General: Provide radiant floor heaters which are suitable for embedment in concrete in the areas and places indicated.
- B. Cable: Single conductor, resistance type wire, insulated with compressed magnesium oxide, with an annealed copper sheath temperature not to exceed 350 degrees F when operated on 480/277 volt electrical service; provided with non heating leads installed at the factory, as shown on the Contract Drawings and as specified herein.
- C. Determine the maximum amperage by the cold lead wire size in accordance with the NEC. Provide UL listed glands for moisture proof attachment of the cable to the junction boxes.
- D. Insulation: Rated 600 volts minimum in accordance with NEC requirements for mineral insulated cable.

### **0.2 SWITCH HEATERS**

- A. Provide heaters having tubular type elements complying with following requirements.
  - 1. Designed to operate on direct current of 600 volts nominal and 700 volts maximum, rated at minimum of 350 watts per foot of effective heating length.
  - 2. Provide switch heater elements conforming to length of switch rail as indicated, having effective length of at least one foot beyond switch point, and with flexible wire leads of 15 feet in length minimum.

### **0.3 THIRD RAIL HEATERS**

- A. Heating Elements: Provide elements fabricated of mineral insulated cable, having active length of 52 feet 6 inches.
- B. Heaters: Provide heaters complying with requirements of Part 2 "Switch Heaters" Article, except rated at 50 watts per foot.
- C. Retainers: Provide stainless steel Type 304 extruded retainers, size and shape as indicated to secure mineral insulated cables in contact with third rail as indicated.

- D.** Fasteners for Retainers: Provide fasteners sizes and types as indicated.

#### **0.4 INFRARED HEATERS**

- A.** General: Quartz tube, quartz lamp, or metal sheath type as indicated, suitable for operation on a 480/277 volt, 60 hertz system.
- B.** Fixture Housings: Steel with baked enamel finish of a color approved by the Engineer, weatherproof construction designed for outdoor application.
- C.** Fixtures. Provide completely wired fixtures equipped with lead wire length, as specified in the Construction Specifications, for connection at circuit junction boxes; UL labeled.

#### **0.5 ELECTRIC CABINET HEATERS, ELECTRIC CABINET CONVECTOR HEATERS, AND UNIT HEATERS**

**A.** General

1. Provide UL labeled heaters having wattage, voltage phase, Btu per hour output, as indicated. Electric cabinet heaters shall be self contained, factory assembled type.
2. Heating Elements
  - a. Nickel chromium heating wire embedded in magnesium oxide insulating refractory and sealed in metallic sheath having fins.
  - b. Having sealed ends and enclosed in terminal box and with element sheath mechanically pressed after filling to insure maximum magnesium oxide compaction.
  - c. Sheath and Fins.
    - 1) Provide sheath and fins having copper plating, high temperature ceramic coating or high temperature aluminized finish and constructed such that heat transfer between sheath and fins in uniform.
    - 2) Provide fins spaced maximum of six per inch.
  - d. Elements free from expansion noise and 60 hertz hum.

**B.** Electric Cabinet Heaters and Electric Cabinet Convector Heaters.

1. Cabinet. Provide heaters with steel cabinets minimum gauges as specified herein, having manufacturer's factory baked enamel finish, color as selected by the Engineer.

**C.** Electric Cabinet Convector Heaters

1. General
  - a. Provide convector heaters consisting of heating elements, casings having inlet and outlet grilles, airflow baffles, and protective devices.

- b. In addition to general requirements above, provide heaters sized as indicated.
- 2. Cabinets
  - a. Constructed of minimum 18-gauge material except removable front minimum 16 gauge.
  - b. Capable of being wall mounted and installed with bottom minimum six inches above finished floor.
  - c. Having inlet and outlet grilles and access to control components.
- 3. Controls and Protective Devices
  - a. Controls
    - 1) Built-in, adjustable, tamper resistant thermostat, tool adjustable without requiring removal of cabinet parts.
  - b. Protective Devices
    - 1) Automatic reset thermal overload line voltage protection.
    - 2) Factory installed safety disconnect switch or circuit breaker.

#### **D. Electric Cabinet Heaters**

- 1. General
  - a. Provide heaters consisting of heating elements, fans, driving motor, air filters, motor switch and casings having inlet and outlet grilles.
  - b. In addition to general requirements above, provide heaters with mountings and CFM delivery as indicated.
- 2. Cabinets
  - a. Constructed of minimum 18 gauge material, with rounded exposed corners; removable front panel secured by either key operated lock spring, or friction catch; either steel bases or supports.
  - b. Having steel supports for fan, heating, coil, and filter.
  - c. Having inlet and outlet louver type grilles, removable front panel for access to control components, motor, fan, heater elements, and filters.

#### **E. Electric Unit Heaters**

- 1. General
  - a. Provide heaters having terminals for control circuits and for single source power supply, and factory installed control transformers.
  - b. In addition to general requirements above, provide heaters with CFM air delivery; number of steps; mounting height; and capable of developing floor area coverage and air throw required by heater layout as indicated.
- 2. Housing
  - a. Provide metal housing to contain heater, fan, motor and auxiliaries, rigidly braced with steel plates or structural steel shapes to prevent vibration and maintain alignment, having

- either galvanized, bonderized, or prime coating and finished with factory baked enamel finish color as indicated.
  - b. Provide housings having ready access to interior parts without requiring unfastening of housing from mounting brackets.
  - c. Provide housings with swivel mounting brackets for wall and ceiling mounting, as indicated.
- 3. Louvers
  - a. Horizontal air discharge units having individually adjustable horizontal louvers to direct discharge air horizontally as desired.
  - b. Louvered back, heavy grilled or wire guard for inlet air.
  - c. Vertical air discharge units, with individually adjustable louvers such that airflow pattern can be adjusted in all directions.
- 4. Fans
  - a. Propeller type fans, directly connected to fan motors, dynamically balanced, and designed specifically for unit heater application and low noise level.
  - b. Fan motors, totally enclosed, continuous duty type, with built-in automatic reset thermal overload protection.
  - c. Bearings
    - 1) Sleeve type bearings having provisions for lubrication, or oil reservoir, and sealed against loss of oil and entrance of dirt.
    - 2) Ball and roller type bearings of self aligning and permanently lubricated type.
- 5. Limit Controls. Provide heater units with thermal overheat protection located to protect against overheating of units from any cause.

## **0.6 CONTROLS**

- A.** General: NEMA Standard Nos. IC 1 and IS 1.1, as applicable; UL listed for the intended use.
- B.** Snow Detectors: Moisture sensing type with built in heating element, to melt the snow as it falls on the detector surface; and thermostat, to prevent actuation by rain.
- C.** Thermostats: Provided with separate replaceable bulbs or sensing elements installed in wells for embedment in concrete slabs. Fill wells with a suitable heat transfer material which will not impair sensitivity or impede removal or replacement of the sensing elements.
- D.** Contractors: Rated for the intended purpose and of proper contact configuration to accomplish the control sequences specified herein and as shown on the Contract Drawings.
- E.** Relays: Required configuration and rated for the intended use.
- F.** Controls for Outdoor Installation: Housed in NEMA 3A, 4 or 4X enclosures as specified in the Construction Specifications.
- G.** Controls for Indoor Installation: Housed in NEMA 1A enclosures.

- H.** Limit Controls. Provide controls rated for intended use and providing thermal overheat protection of heating units and located to protect against overheating of units from any cause.

## **0.7 FABRICATION**

- A.** Third Rail Heating Elements: Fabricate elements as required to comply with following requirements:

1. Heater Sheath
  - a. Tolerances: Minimum finished wall thickness of 0.020 inch plus or minus 0.001 inch; and outside diameter of 0.3125 inch plus or minus 0.010 inch.
  - b. Provide high nickel chromium alloy type having following chemical composition:

	<u>Elements</u>	<u>Percent</u>
1)	Nickel with cobalt	76.0
2)	Iron	8.0
3)	Chromium	15.5
4)	Trace elements	0.5
  - c. Chemically clean prior to fabrication into heater units as required to remove surface contaminants.
2. Heater Resistance Elements: Nickel chromium single element, non helical type.
3. Heating Element Insulation. Provide minimum 99 percent pure electrical grade magnesium oxide tightly packed with no voids.
4. Heating Lengths and Sections
  - a. Minimum element to sheath dimension: 0.090 inch.
  - b. Terminate each end of heating length to six inch length of single conductor, No. 8 copper mineral insulated non heating lead through brass fitting silver soldered to each mineral insulated sheath to form hermetic seal.
  - c. Silver solder resistive elements of heating sections to current carrying conductor of non heating lead.
5. Non Heating Sections
  - a. Provide sections terminated in flexible lead of No. 6 AWG, 37 strand, one kV rated cable, having minimum length of 20 feet.
  - b. Silver solder flexible leads to non heating lead within copper fitting, which shall be silver soldered to mineral insulated sheath, filled with epoxy and crimped around flexible lead.
  - c. Provide flexible leads tinned 1/2 inch back from end, and silver soldered to conductor of non-heating leads.
  - d. Provide cable insulation having heat resistant rubber compound insulation minimum 1/16 inch thick overlaid with an oil resistant sheath 3/64 inch thick.

- B.** Provide cable fittings with following information stamped on them or on stainless steel tag affixed to non heating mineral insulated cable section.

1. Name of manufacturer
2. Catalog number of heater
3. Total wattage
4. Watts per foot
5. Voltage
6. Current
7. Manufacturer's order number and item number

### **PART 3 - EXECUTION**

#### **0.1 RADIANT FLOOR HEATING CABLE**

- A.** Install radiant floor heating cable to be placed in concrete, in accordance with the NEC and applicable codes, and manufacturer's instructions.
- B.** Megger Testing
  1. Test heater cable insulation before installation in accordance with NEC and applicable codes.
  2. Obtain insulation resistance of minimum 50 megohms using 1000-volt direct current megger.
- C.** Install the heater cables in accordance with the arrangement indicated on the Drawings, in straight lines with the bending radius to be in accordance with the cable manufacturer's recommendations. No bends of less than five times cable diameter will be permitted.
- D.** Do not install cable sheaths directly on top of pipe nor in such manner that they cross or touch one another.
- E.** Provide watertight fittings, Type "O", UL listed, at cable terminations.

#### **0.2 SWITCH HEATERS**

- A.** Install switch heaters in accordance with the NEC, AREA, applicable codes, and as indicated.

#### **0.3 INFRARED HEATERS**

- A.** Mount infrared heaters with standard adjustable mounting bracket positioned as indicated.

#### **0.4 THIRD RAIL HEATERS**

- A.** Install third rail heaters as indicated.

## **0.5 FIELD TESTS**

- A.** General. Demonstrate to the Engineer that the systems as installed function as specified herein and as shown on the Contract Drawings.
- B.** Embedded Heating Elements
  - 1. In addition, during the course of installation of embedded heating elements, make and record a series of continuity and megger readings made between heating element sheath, as follows:
    - a. Prior to installation;
    - b. After installation but before placement of concrete;
    - c. Immediately after placement of concrete;
    - d. At half hour intervals for the first four hours after placement of concrete;
    - e. At four hour intervals for the next eight hours; and
    - f. At 24 hours after placement of concrete.
  - 2. If the readings show a failure of the cable or sheath at any time during these periods or before the system is accepted, remove and replace the cable at no additional expense to the Authority.

## **PART 4 - MEASUREMENT AND PAYMENT**

### **0.1 MEASUREMENT**

- A.** Electric heating equipment will be measured as per each complete in place, including all preparation, accessories and incidentals.

### **0.2 PAYMENT**

- A.** Payment for electric heating equipment will be made at the Contract unit price for the quantities as specified above.

### **0.3 PAYMENT ITEMS**

ITEM NO.	DESCRIPTION	UNIT
1681.103	ELECTRIC INFRARED HEATING FIXTURES	EA

## **END OF SECTION**